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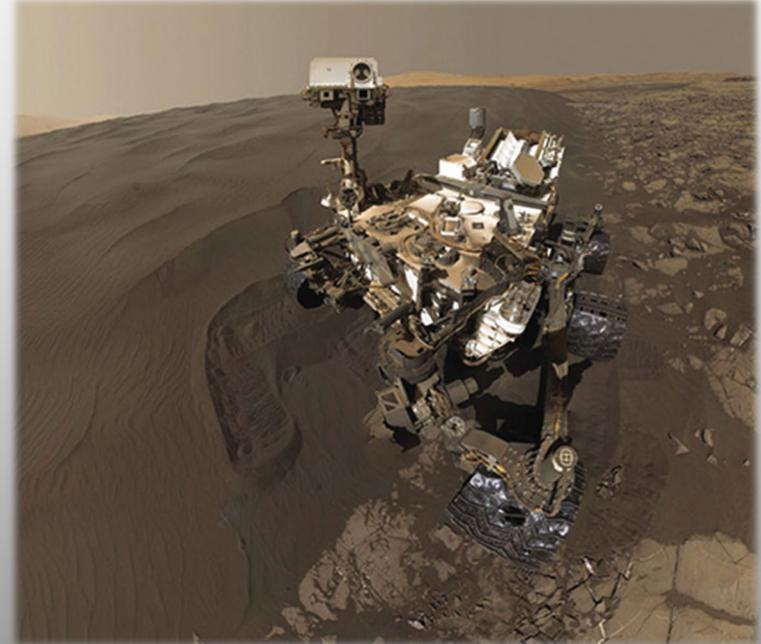
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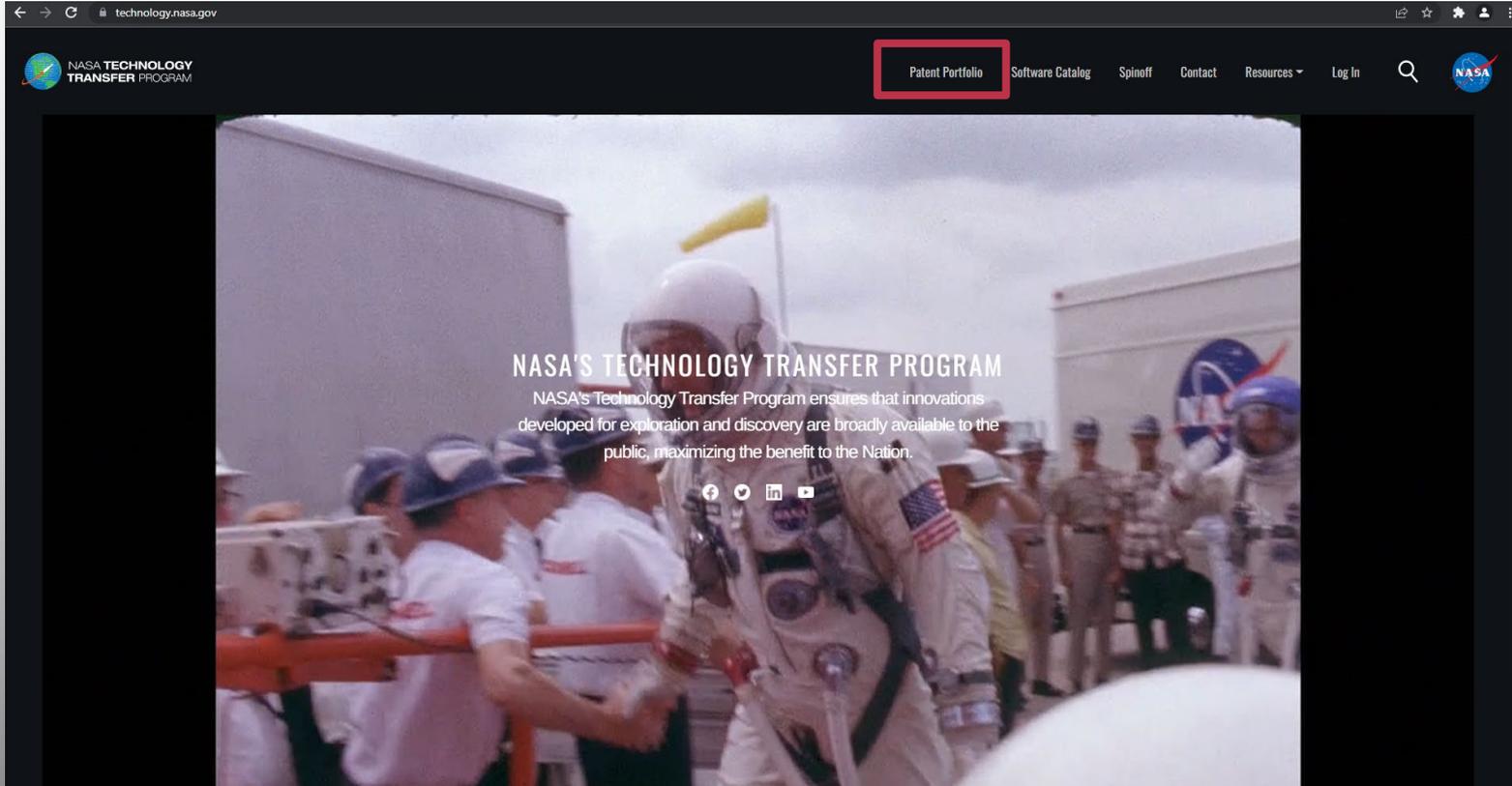


Mineral Analyzer Shakes Answers Out of Soil and Rocks



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Instrumentation

Real Time Radiation Monitoring Using Nanotechnology (TOP2-236)

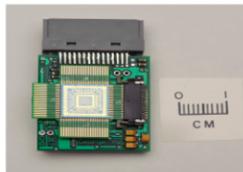
Carbon nanotube chemical sensors

Questions?

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Overview

NASA has patented a unique chemical sensor array leveraging nanostructures for monitoring the concentration of chemical species or gas molecules which is not damaged when exposed to protons and other high energy particles over time. The nanotechnology-enabled chemical sensor array uses single walled carbon nanotubes and metal catalyst-doped single walled carbon nanotubes (SWCNTs) and polymer-coated SWCNTs as the sensing media between a pair of interdigitated electrodes (IDE). By measuring the conductivity change of the SWCNT device, the concentration of the chemical species or gas molecules can be measured. These sensors have high sensitivity, low power requirements, and are robust and have a low manufacturing cost compared to other commercial chemical sensors for detection of trace amount of chemicals in gasses and liquids.



The Technology

Carbon nanotube chemical sensors are suitable for sensing different analytes. Such sensors can be configured in the form of an array to comprehensively and cost-effectively monitor multiple analytes. A 32-sensor array on a silicon chip was tested under the proton exposure at two energy levels, with three different fluences. The result of the proton irradiation experiment indicates that this SWCNT device is sensitive to the proton exposure at different levels and it recovers upon turning off the incident radiation. Carbon nanotube-based sensors are particularly suitable and promising for chemical and radiation detection, because the technology can be used to fabricate gas or liquid chemical sensors that have extremely low power requirements and are versatile and ultra-miniature in size, with added cost benefits. Low-power carbon nanotube sensors facilitate distributed or wireless gas sensing, leading to efficient multi-point measurements, and to greater convenience and flexibility in performing measurements in space as well as on Earth.

Benefits

- High sensitivity
- Capable of proton radiation detection.
- Tunable sensing properties through manipulation of nanostructured materials for selectivity
- Small size and lightweight
- Reliable sensor performance from chip to chip
- High yield and scalable sensors with a low cost for mass production
- Lower power consumption which is ideal for wireless monitoring
- Capability of built-in intelligence onto the sensor chip
- Simple electronic design for easy measurement and integration

Applications

- Petrochemical industry
- Nuclear industry
- Industrial and civil applications
- Defense applications
- Medical / Biomedical
- Spacecraft

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Technology Details

Category	Patent(s)
instrumentation	9,297,907
Reference Number	
TOP2-236	
Case Number(s)	
ARC-16001-1	

Tags: aerospace chemical plants composite materials gas sensors industrial manufacturing materials medical military natural gas nuclear security sensors

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Aeronautics and Space Administration
Principal Investigator: Dan Lockney
Technology

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Carbon nanotube chemical sensors

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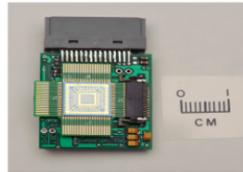
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Very Important! – Patent Claims

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Patent number hyperlinks to USPTO site.

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Aeronautics and Space Administration
Principal Investigator: Dan Lockney
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(1 of 1)

United States Patent

Li, et al.

9,297,907

March 29, 2016

Real time radiation monitoring using nanotechnology

Abstract

System and method for monitoring receipt and estimating flux value, in real time, of incident radiation, using two or more nanostructures (NSs) and associated terminals to provide closed electrical paths and to measure one or more electrical property change values .DELTA.EPV, associated with irradiated NSs, during a sequence of irradiation time intervals. Effects of irradiation, without healing and with healing, of the NSs, are separately modeled for first order and second order healing. Change values .DELTA.EPV are related to flux, to cumulative dose received by NSs, and to radiation and healing effectivity parameters and/or mu., associated with the NS material and to the flux. Flux and/or dose are estimated in real time, based on EPV change values, using measured .DELTA.EPV values. Threshold dose for specified changes of biological origin (usually undesired) can be estimated. Effects of time-dependent radiation flux are analyzed in pre-healing and healing regimes.

Inventors: Li; Jing (San Jose, CA), Wilkins; Richard T. (College Station, TX), Hanratty; James J. (San Francisco, CA), Lu; Yijiang (San Jose, CA)

Applicant:

Name	City	State	Country	Type
The United States of America as Represented by the Administrator of NASA	Washington DC	US		

Assignee: The United States of America as Represented by the Administrator of the National Aeronautics & Space Administration (NASA) (Washington, DC)

Family ID: 55537429

Appl. No.: 14/205,003

Filed: March 11, 2014

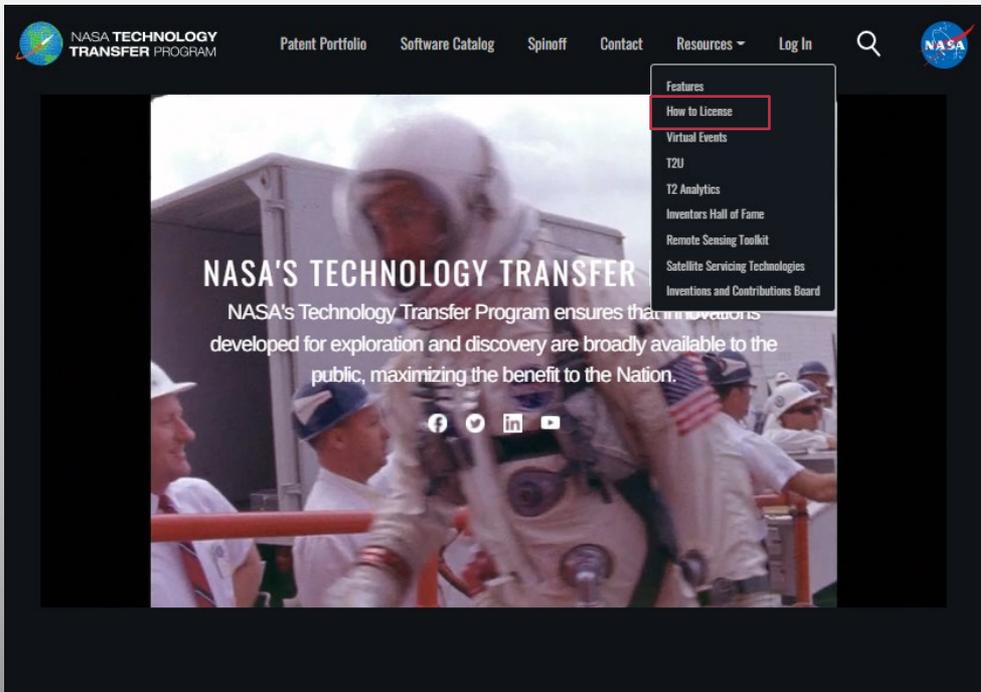
Claims

What is claimed is:

1. A method for real time monitoring of radiation received, the method comprising: providing an array of at least two spaced apart nanostructures (NSs) that each extend between and electrically connect first and second terminals of an electrical property change value sensing mechanism, to form a closed electrical path, where the sensing mechanism senses a change value .DELTA.EPV in a selected electrical property value EPV associated with the at least two nanostructures; providing the at least two NSs with a selected coating or deposit to functionalize the at least two NSs to respond to exposure to incident radiation by a change value .DELTA.EPV in the electrical property value; providing or measuring at least one initial electrical parameter value EPV0 for the closed electrical path before exposure of the at least two NSs to incident radiation; exposing the at least two NSs to the incident radiation from a source of incident radiation particles having a representative particle flux, phi, and a representative particle energy E; measuring change values, .DELTA.EPV(0,t1) and .DELTA.EPV(0,t2), in the electrical property value EPV for measurement time intervals, t0, t1, t2, t3, t4, t5, t6, t7, t8, t9, t10, t11, t12, t13, t14, t15, t16, t17, t18, t19, t20, t21, t22, t23, t24, t25, t26, t27, t28, t29, t30, t31, t32, t33, t34, t35, t36, t37, t38, t39, t40, t41, t42, t43, t44, t45, t46, t47, t48, t49, t50, t51, t52, t53, t54, t55, t56, t57, t58, t59, t60, t61, t62, t63, t64, t65, t66, t67, t68, t69, t70, t71, t72, t73, t74, t75, t76, t77, t78, t79, t80, t81, t82, t83, t84, t85, t86, t87, t88, t89, t90, t91, t92, t93, t94, t95, t96, t97, t98, t99, t100, t101, t102, t103, t104, t105, t106, t107, t108, t109, t110, t111, t112, t113, t114, t115, t116, t117, t118, t119, t120, t121, t122, t123, t124, t125, t126, t127, t128, t129, t130, t131, t132, t133, t134, t135, t136, t137, t138, t139, t140, t141, t142, t143, t144, t145, t146, t147, t148, t149, t150, t151, t152, t153, t154, t155, 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Overview

NASA has patented a unique chemical sensor array leveraging nanostructures for monitoring the concentration of chemical species or gas molecules which is not damaged when exposed to protons and other high energy particles over time. The nanotechnology-enabled chemical sensor array uses single walled carbon nanotubes and metal catalyst-doped single walled carbon nanotubes (SWCNTs) and polymer-coated SWCNTs as the sensing media between a pair of interdigitated electrodes (IDE). By measuring the conductivity change of the SWCNT device, the concentration of the chemical species or gas molecules can be measured. These sensors have high sensitivity, low power requirements, and are robust and have a low manufacturing cost compared to other commercial chemical sensors for detection of trace amount of chemicals in gasses and liquids.



The Technology

Carbon nanotube chemical sensors are suitable for sensing different analytes. Such sensors can be configured in the form of an array to comprehensively and cost-effectively monitor multiple analytes. A 32-sensor array on a silicon chip was tested under the proton exposure at two energy levels, with three different fluences. The result of the proton irradiation experiment indicates that this SWCNT device is sensitive to the proton exposure at different levels and it recovers upon turning off the incident radiation. Carbon nanotube-based sensors are particularly suitable and promising for chemical and radiation detection, because the technology can be used to fabricate gas or liquid chemical sensors that have extremely low power requirements and are versatile and ultra-miniature in size, with added cost benefits. Low-power carbon nanotube sensors facilitate distributed or wireless gas sensing, leading to efficient multi-point measurements, and to greater convenience and flexibility in performing measurements in space as well as on Earth.



Benefits

- High sensitivity
- Capable of proton radiation detection.
- Tunable sensing properties through manipulation of nanostructured materials for selectivity
- Small size and lightweight
- Reliable sensor performance from chip to chip
- High yield and scalable sensors with a low cost for mass production
- Lower power consumption which is ideal for wireless monitoring
- Capability of built-in intelligence onto the sensor chip
- Simple electronic design for easy measurement and integration

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NASA offers an "Evaluation License" option that will allow you short-term permission to explore the potential of a technology and learn if it will fit into your business development goals. An evaluation license is also required if you intend to enter into an agreement to have NASA conduct testing on the technology on your behalf. *(no cost eval license is available if you're using tech for SBIR)*

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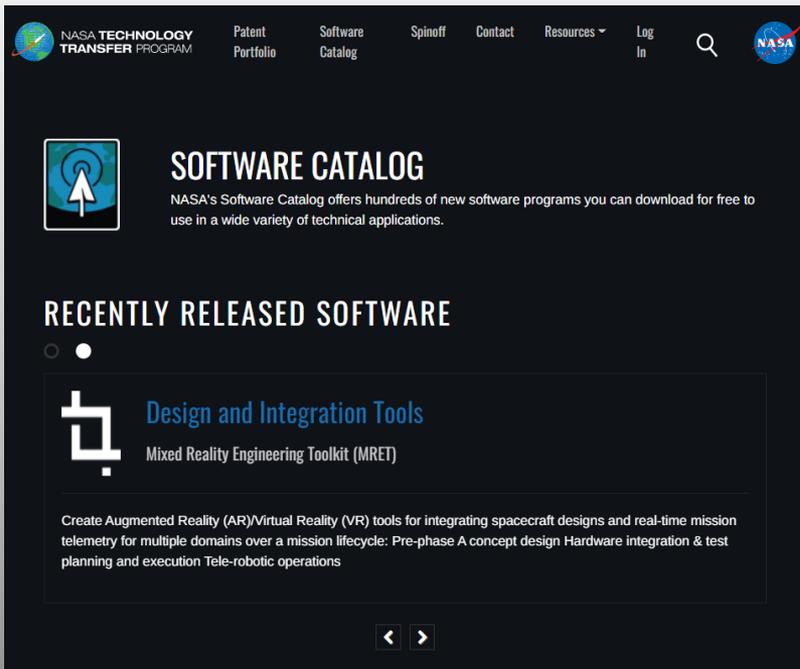
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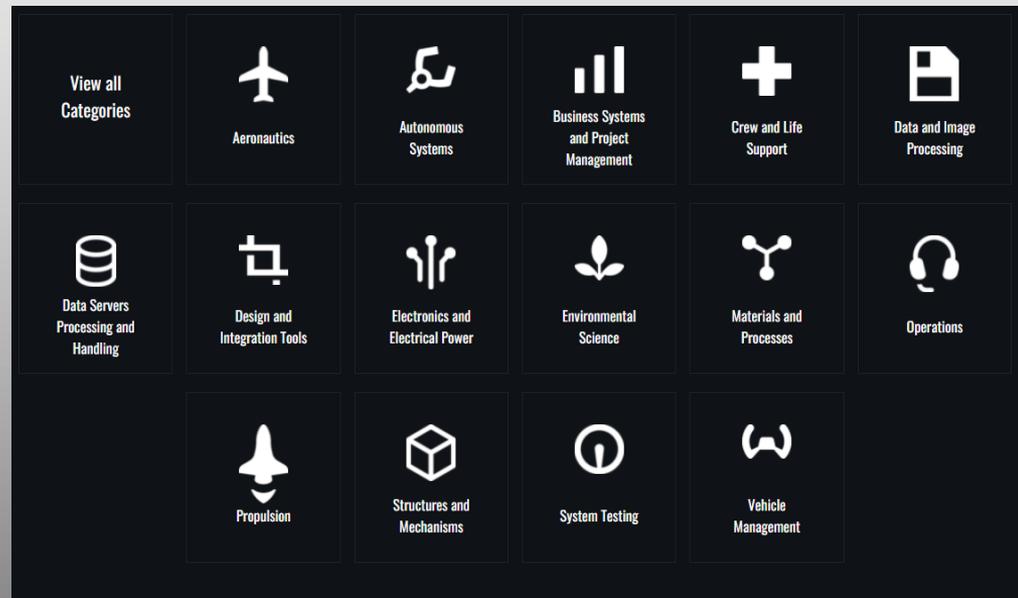
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A grid of 18 software categories, each represented by an icon and a label:

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What is left “undone” in your company/group that you might search
NASA technology for a solution?

